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THE LOW POTENCIES OF HOMŒOPATHY

(AN ACCOUNT OF SOME PHYSICAL PROPERTIES INDICATING ACTIVITY)

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A RESEARCH CARRIED OUT ON BEHALF OF THE BEIT RESEARCH COMMITTEE, BRITISH HOMŒOPATHIC ASSOCIATION

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CONTENTS

SUMMARY

An account is given of the method of preparation of the homœopathic potency. Research methods are described by which investigations were carried out on :—

1. An insoluble metal.
2. A salt.
3. A simple organic substance.
4. A radio-active salt.
5. Organic substances containing alkaloids.

By these methods low potencies of various homœopathic preparations were shown to be capable of identification by spectroscope, fluorescent and Geiger counter methods. The clear watery tincture of gold produced by the method of Hahnemann is thus shown to contain gold, a fact denied by many. Those who wish to experiment are therefore able to do so with the assurance that the materials they use contain constituents of the original substances. It is pointed out that the action is definitely selective and individualistic, and that the correct method of choice and demonstration must be followed to obtain results of a convincing character. The work was carried out partly by S. Judd Lewis, D.Sc., F.I.C., partly by F. W. Harris, F.I.C., and partly by Dr. W. E. Boyd, working for the Beit Research Committee of the British Homœopathic Association.

THE LOW POTENCIES OF HOMŒOPATHY

(AN ACCOUNT OF PHYSICAL RESEARCH)

THE homœpathic so-called minute dose has caused more difficulty in the consideration of homœopathy than any other feature of its principles or theory. It is therefore essential to emphasise that the actual principle of homœopathy is independent of the use of the apparent microdose. It is entirely possible to test out the therapeutic maxim " Similia similibus curentur " with doses which are easily acceptable in these days of the biological assaying of internal secretions and vitamins.

Only recently Langdon Brown pointed out the potency of the minute dose when considering the therapeutics of vitamins and hormones. " The body," he stated, " worked with fractions of a milligram. The potency of a hormone is enormous. Abel's extract of the posterior lobe of the pituitary can produce contractions of the uterus when one part is dissolved in 15,000 million parts of water."

It is possible to test out the homœopathic principle with dosage in material amount, provided this amount is sufficiently small to be stimulative and not depressant to the affected tissue. Some results have been obtained by use of small doses of tincture without much solution of them in any diluent. The

homœopathic action of the drug is apt, however, in sensitive patients, to be obscured by its direct gross physiological action. It was in an attempt to escape from this that Hahnemann began to attenuate his original tinctures of soluble substances. In addition, he desired to experiment with attenuations of apparently insoluble substances, and in his endeavours to do this he made one of the brilliant discoveries which brought on him at the time scorn and criticism, but which can now by modern methods be shown to have been scientifically correct. Hahnemann's solution of metallic gold appeared to his contemporaries an absolute impossibility, yet, as will be seen later, time and modern instruments have shown his experiments to be evidence of his great intuition and powers of exact observation.

To avoid gross physiological action by attenuation Hahnemann evolved a method of preparation which was definitely distinct from simple dilution. Knowledge about the preparation of homœopathic drugs is frequently wanting amongst critics, and this has led to many uninformed statements on the subject of these so-called dilutions.

The method of Hahnemann consisted of (*a*) The use of small quantities of drug and diluent; (*b*) exact dilution; and (*c*) definite succussion. The scales of dilution were decimal and centesimal. In the former case one part of drug to nine parts of diluent formed the first decimal stage. This mixture was then succussed heavily, the number of succussions being usually ten. The important point was

that the number of succussions per stage should be constant for any one preparation. Of the first stage one part was taken to nine parts of the same diluent and so on. The stages were termed 1x, 2x, etc. When the centesimal scale was used, the dilution was in the proportion of one part to ninety-nine parts of diluent and the stages were termed 1c, 2c, etc. This method, using either scale, was followed when extractives were prepared or soluble substances, the diluent being distilled water or preferably a fixed proportion of alcohol and water. When insoluble substances such as metallic gold were prepared, then in place of the diluent lactose was used, and prolonged trituration in a mortar carried out at each stage. When the 6x stage of trituration had been reached the material was placed in a mixture of alcohol and water capable of dissolving lactose, when, Hahnemann claimed, the gold went into the solution and could be administered in this form. The method of determination of the strength of the original tincture of each drug was laid down, but as the preparation of these " mother tinctures " is more a matter of pharmacological interest, readers are referred to the " Homœopathic Pharmacopœia " for detailed information. It will be seen therefore that the homœopathic drugs can be dispensed either as " mother tinctures " or as triturations or as solutions designated either 1x, 2x, etc., or as 1c, 2c, etc.

On carrying out these procedures and on administration of drugs in this prepared form Hahnemann was astounded to discover that the homœopathic action of the drug appeared to be definitely increased.

By homœopathic action is meant the action of the drug in accordance with the homœopathic principle, which, it must be remembered, necessarily involves extreme selectivity of action. In other words, homœopathic action only takes place when the conditions enabling the action to be really " similar " are satisfied.

It is this selectivity of action and this distinctive " homœopathic " activity of the drugs which are necessary factors for successful use of these remedies. Selectivity of action is not only observable biologically, as in the selectivity of vitamines or in the response to soft or hard irradiation of different types of tumour cells, but also in physical experiments. For example, to make nickel emit its characteristic X-radiation it is useless to irradiate it by Cu-rays, but Zn-rays will act, or rays more penetrating.[1] If the homœopathic remedy given has no selective action on the appropriate affected cell constituents of the individual, then no action takes place. Hence will be seen the futility of applying homœopathic preparations in the expectation of getting a response when only the ordinary gross physiological action of the drug is required. I have, for example, known of a specialist who prescribed homœopathic belladonna where a gross atropin effect was desired, and based his criticism on the failure of that experiment.

We have seen that it is desirable to experiment in homœopathy with the homœopathic preparations rather than with the crude drugs or concentrated tinctures. It is probably more acceptable to an

interested physician that he should for his preliminary trials use preparations of an order of dilution which he can accept as being physically active, as containing definite evidence of the original source, as well as being recommended as homœopathically active. Modern physical research has been carried on persistently by the Beit Research Committee of the British Homœopathic Association into any physical methods likely to enhance the confidence of the experimenter in Homœopathy that he is administering solutions which are capable of definite physical or chemical action as shown by modern methods. It is clear that if any drug can be shown in a stage of homœopathic preparation to be capable of a definite physical activity, then it is decidedly within the bounds of probability that it can have a definite biological action, not necessarily in the gross physiological mass sense, but rather along such lines as radio-activity, molecular modification, surface energy effects, and electrical variations, according to the nature of the material considered.

It then follows that no objection can be taken, on the grounds of impossibility, to an experiment to discover whether there is any resultant effect from the application of the selective action, in their specially prepared form, of homœopathic drugs. Like all other experimental work, the technique of the experiment must be correct to obtain results, and no results will be obtained if the correct technique of homœopathic selection and administration of these drugs is neglected.

The homœopathic solutions were termed potencies

by Hahnemann, because he found that he obtained more marked homœopathic action with the specially prepared solutions than with the ordinary dilutions. The range of potencies is divided into low and high, the low being of the order of 1x, 2x, to 6x, the high being solutions of the order of 12c and upwards. For initial experimentation it is possible to satisfy ourselves as to the homœopathic principles of drug action with these low potencies properly administered.

This section of the research investigation on potencies is therefore confined to the evidence for the presence of original substances in certain of the low potency solutions and to evidence of their power of physical activity either optically, chemically, or otherwise, in such a range of types of drugs that it is entirely reasonable to accept the presence of similar qualities in other members of the same type.

The substances considered were: (1) An insoluble metal; (2) A salt; (3) A simple organic substance; (4) A radio-active salt; (5) Organic substances containing alkaloids.

For the demonstration of the activity of these preparations widely different methods of analysis had to be used, supplying the important comment that no one method of analysis can be used in any one sphere of science on which to base negative conclusions. Positive results depend on the selection of the suitable method or instrument, and even then are limited by the sensitivity of the method used.

Practically the only forms of homœopathic drugs which could not be examined by physical methods

FIG. 1.—Spectrogram of 7x Aurum Met. tincture. (Judd Lewis.)
(From "The Emanometer and Disease" by W. E. Boyd,
Br. Hom. Jour., October, 1935.)

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were the snake poisons, but the very deadliness of these will make the question of the activity of low potency preparations of these one requiring little argument. Biological methods can be applied to the investigation of these poisons, but such means lie outside the scope of this paper.

The outstanding criticism against the homœopathic preparations was directed against Hahnemann's solutions of metallic gold. We are less sceptical nowadays when we deal so frequently with colloidal preparations, but it is to be remembered that these are electrically or chemically prepared colloids and are frequently compounds of the metal with protein decomposition products, *i.e.*, combined as organic salts.[2] It was Hahnemann who applied trituration to the production of a clear solution of pure gold long before the ultra-microscope made visible the Brownian movement of colloidal particles. After experimental work on the trituration it was decided to obtain expert assistance in the spectroscopic analysis of the gold tincture. In the figure shown (Fig. 1) it will be seen that the spectrogram taken by Dr. Judd Lewis, using a 7x Aurum Metallicum tincture, shows the definite presence of gold. The nature of this solution is, in his opinion, probably colloidal, with very fine particles.[3] Thus is Hahnemann justified by modern physical methods, as far as his preparation of insoluble metals is concerned. Experimental work on homœopathic lines with a 7x tincture of aurum metallicum therefore becomes entirely justifiable from a present scientific standpoint.

For the purpose of demonstration of a salt, the homœopathic preparation of Arsenicum Album was submitted by the Public Analyst of Glasgow to examination by means of a modification of the Gutzeit test, the stains being examined by ultra-violet radiation. Arsenic was definitely shown to be present in the 7x stage of preparation by dilution and succussion.[3] There is no reason to suppose that with a similar careful preparation similar stages of other salts should not contain the substances to be tested in homœopathic experimentation in at least the 7x stage. While modern physical methods only permit of analysis of certain of the homœopathic preparations at stages such as the 5x, yet the fact that they do so establishes the reality of the preparations and makes experimentation reasonable.

Although unsuitable for examination in the later potency stages an emission spectrographic examination of the mineral constituents of Lycopodium was also carried out by Judd Lewis.[3] The spectrogram shown makes clear that far from being an inert dusting powder as used in allopathic circles we have in lycopodium a source of tincture containing a number of constituents which might prove of definite value for experiment. The 1x and 2x together with the ϕ tincture (mother tincture) can thus be shown to have present definite constituents obtained from the original. That there are many other constituents not demonstrable by this method is also known, but this spectrogram serves to demonstrate that lycopodium tincture should be considered

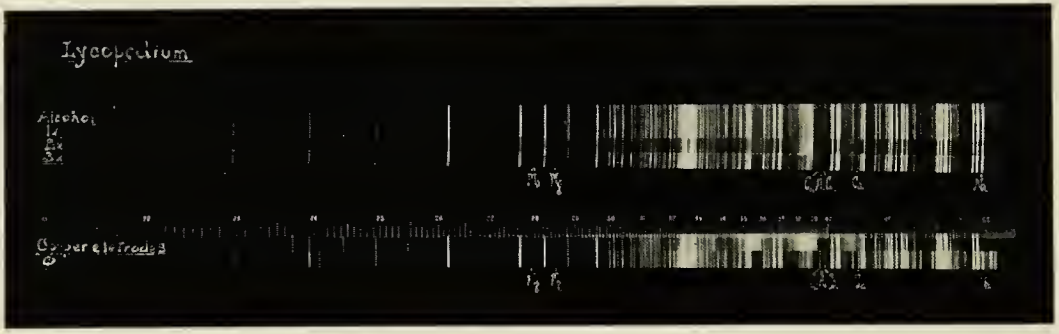

FIG. 2.—Spectrogram of low potency of Lycopodium tinctures. (Judd Lewis.)

[To face page 15

by no means an inert substance (Fig. 2). In the potencies mentioned their presence was clearly more evident than in the control, thus showing their origin. It is not, however, to be understood that the constituents shown are the only ones in the original lycopodium. Both chemically and spectroscopically lycopodium shows the presence of copper, iron, aluminium, manganese, calcium, magnesium, sodium, potassium, silicon, and boron, the remainder of the ash consisting of phosphoric acid derived from the total phosphorus content.[4] As a matter of fact, lycopodium in potency is one of the most valued remedies of the homœopathic pharmacopœia.

The wide variety of mineral ingredients present in a natural form in a number of well-known homœopathic drugs as also in the initial stage of mother tincture (ϕ) was described in 1914 by Judd Lewis.[4] At that time the analysis was given of baptisia, belladonna, colchicum, lycopodium, thuja, and sepia, but we are here more concerned with the evidence of physical or chemical properties in the actual solutions of the homœopathic drugs.

Even more definite evidence of physical activity in these lower potency stages may be shown by using the special properties of Radium Bromide. Modern physical methods have been markedly developed for the detection of gamma rays from radium salts, and we applied some of these methods in our Glasgow laboratory with most interesting results. Using a Rajewsky modified Geiger counter, such as is used for the detection of cosmic "rays" and

gamma rays, we tested radium bromide prepared by homœopathic methods. The photographs show the registration of the number of ionisation shocks produced in the Rajewsky counter without and with a well-corked bottle of Radium Bromide tincture approximated to the apparatus. Action took place through the bottle (Jena glass) and through a sheet of brass. For the purpose of the experiment it was immaterial as to whether the effect was due to primary radiation or whether due to secondary radiation set up by the radiation from the tincture. The ionisation shocks in the counter were registered through an amplifier and could be heard on a loud-speaker simultaneously with the taking place of registration by means of a slow camera and an Einthoven oscillograph with a copper fibre. The record in each case lasted ten minutes, and by comparison over a large number of controls, was found to prove indubitably the marked physical activity of the tincture examined. The record shows the activity of the 6x and 7x tinctures of radium bromide, *i.e.*, equivalent to 1 part in 10,000,000, while electroscopic tests with the same series of preparations showed activity with the 10x, *i.e.*, 1 part in 10,000,000,000. A paper dealing with these Radium Bromide experiments appeared in the *British Journal of Radiology*, with details of the methods used [5] (Fig. 3).

In order to show the regularity of the methods of attenuation used, as well as to demonstrate the presence in low potencies of substances present in or associated with the original drug, additional most

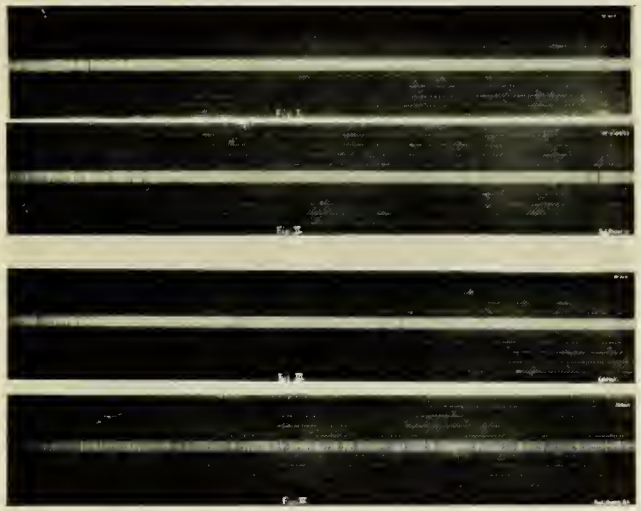

FIG. 3.—Oscillograph record of ionisation shocks in Rajewsky-Geiger Counter. 1, Control; 2, Rad. Brom. 7x (1×10^{-7}); 3, Control; 4, Rad. Brom. 6x.

The movement of the oscillograph fibre shows as a vertical black line on the white.

(From The Radioactivity of Radium Bromide Solutions for Internal Medication by W. E. Boyd. *Br. Journ. Radiology*, August, 1934.)

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valuable examinations were carried out by Dr. Judd Lewis, using China, *i.e.*, Peruvian bark, and Nux Vomica.[3] Consecutive potencies, as his report points out, were examined by very modern methods[4] of absorption spectroscopy, exploring especially the ultra-violet region of the spectrum. The advantage of this method was that examination was carried out without disturbing the physical balance or composition of the specimen. The only difference from the normal preparations was that a very pure alcohol was used, so as to definitely exclude any criticism that results were due to impurities in the alcohol (Figs. 4, 5).

Appendix A gives particulars of the preparation of the drugs, while Appendix B contains the technical details of the Judd Lewis and other reports. It will be seen from the charts and tables how markedly regular is the absorption grading in the series of dilutions, while the experiments show the persistence of certain properties of the original drug source in the 7x potency of China, and the 5x of Nux Vomica.

It has thus been possible to show by the latest research methods that definite physical or chemical properties are present in homœopathic preparations of widely different origins. It would therefore appear that there is no reason for criticising either the methods of preparation or activity of the homœopathic low potencies, and that experimentation is therefore neither unreasonable nor impossible along the lines claimed to give results by those who use these drugs in accordance with the correct technique of administration and dosage.

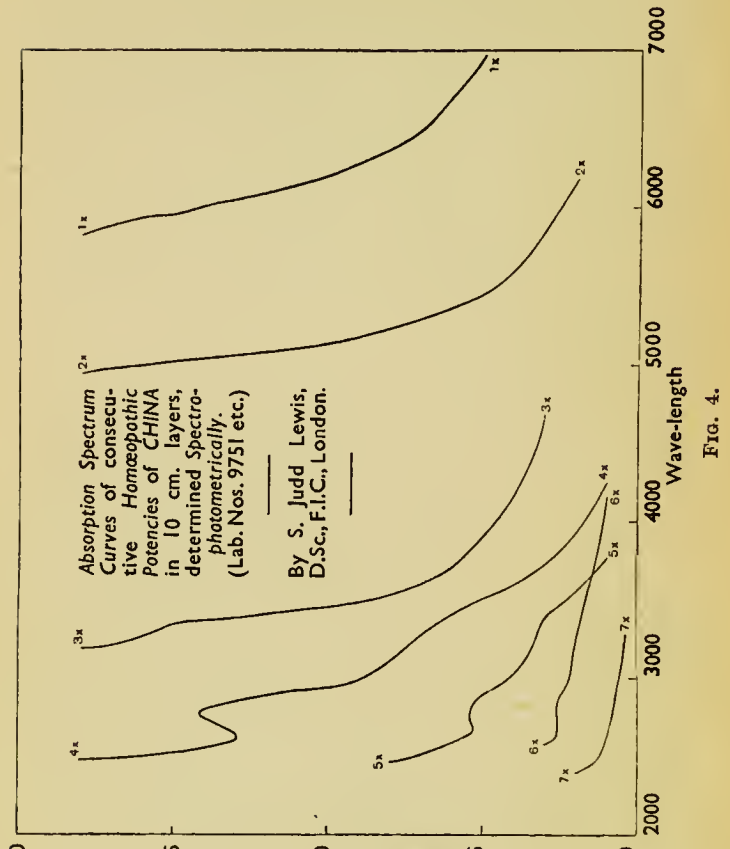
Absorption Spectrum Curves of consecutive Homœopathic Potencies of CHINA in 10 cm. layers, determined Spectrophotometrically. (Lab. Nos. 9751 etc.)
By S. Judd Lewis, D.Sc., F.I.C., London.
Extinction Coefficient
Wave-length
2.0
1.5
1.0
0.5
0
2000
3000
4000
5000
6000
7000
1x
2x
3x
4x
5x
6x
7x

FIG. 4.

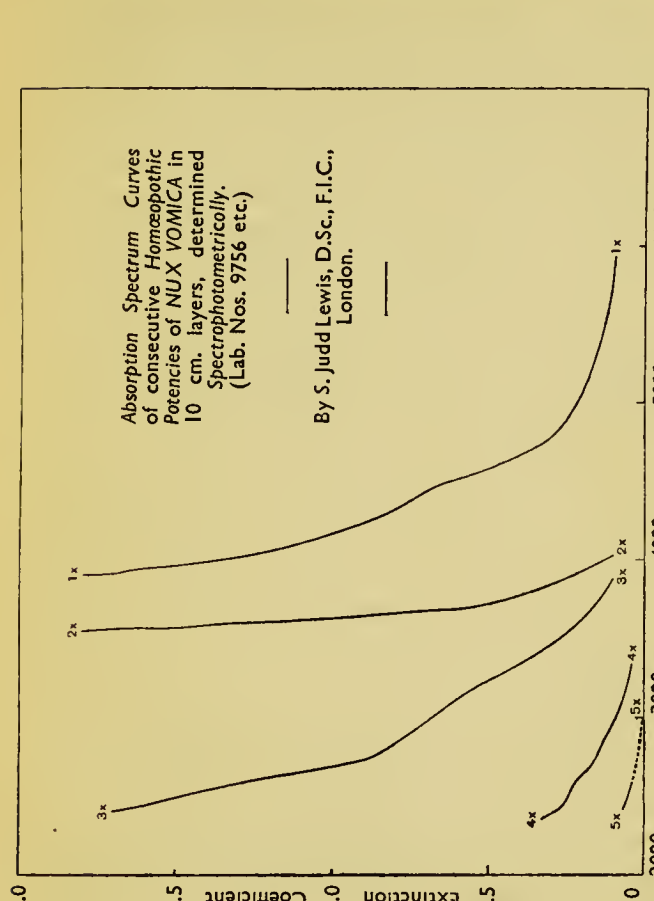
Absorption Spectrum Curves of consecutive Homœopothic Potencies of NUX VOMICA in 10 cm. layers, determined Spectrophotometrically. (Lab. Nos. 9756 etc.)
By S. Judd Lewis, D.Sc., F.I.C., London.
Extinction Coefficient
Wave-length
2.0
1.5
1.0
0.5
0
2000
3000
4000
5000
6000
7000
1x
2x
3x
4x
5x

FIG. 5.

It will be seen that the low potencies referred to have been studied at stages of dilution varying in the case of different drugs from 1x to 10x, *i.e.*, 1×10^{-1} to 1×10^{-10}. The biological activities of solutions of similar attenuation are known experimentally. Bose, for example, has shown that the assimilation of plants can be enhanced 200 per cent. by certain substances in a dilution of $1 \times 10^{-9.6}$ Bogert, of the Chemistry Department, Columbia University, New York, has shown that mercaptan can be detected by the olfactory nerves in an attenuation of 1×10^{-8},[7] while Bronfenbrenner, of Harvard University Medical School, found botulismus toxin capable of killing mice in an attenuation of 1×10^{-20}, provided the *p*H was kept equal to 4.[8] Walbum, of the State Serum Institute, Copenhagen, has demonstrated very definite effects on tar carcinoma in mice using an attenuation of 10^{-11} to 10^{-15} molares of silver solution. The interesting point about this biological research was that this range of dosage was found to be the optimum one. The reasons for this are discussed fully by him.[9]

The effect of subdivision on phenomena due to surface energy has suggested the possibility of this being the method of action of such subdivided substances. If we take a cube of gold 1 cm. along the edge and subdivide it until it reaches a subdivision where the particles almost reach the limit of ultramicroscopic visibility ($10\mu\mu$), we would have a total surface of over 600 square meters and a specific surface of 6×10^{6}.[10] In other words, when a

substance is subdivided the increase of internal surface in proportion to its volume relative to the solution in which it is dispersed is enormous. That surface tension effects are of physiological importance has been shown in relation to electrical stimulus of muscle and nerve.[11] On the other hand, while this surface effect might be involved in the action of the low potencies, the explanation is not satisfactory for the higher potencies, and one is inclined to believe that the method of action must be one common to both the low and high potencies.

It may be argued that, while one may admit that there are evidences of properties indicative of the original drug, the quantity is so small that often in ordinary circumstances, owing to the prevalence in most water supplies or elsewhere of many constituents, which are given as homœopathic drugs, people must be getting continuously quantities of the same order. An example is the arsenic which is to be found in lobster. As far as the actual homœopathic preparation of drugs is concerned it is evident that any of the normal substances found in the average pure alcohol and distilled water used as diluent are at constant concentration throughout the preparation and that the only factors having any clinical activity are those which are subdivided relative to the constant diluent. Subsidiary substances such as the cadmium found with zinc, the silver in copper or the strontium with calcium, do not confuse the issue, as the choice of the prepared drug for administration is dependent on the selective action noted during the " proving " or testing out

of the same substances with their usual accompanying substances on volunteers or sensitive subjects. It is necessary, moreover, to realise that success in treatment depends on the specificity of the drug constituent, *not only for cells sensitised by disease, but for these cells in a distinctive type of individual.* It is also to be emphasised that for the most effective action the method of preparation is definitely different from simple dilution, and that the clinical action appears to depend on these two factors. They lie outside the field of spectroscopic or chemical analysis and lie in the field of biological response. Hence the investigation of these factors can only be made by direct experimentation under correct conditions and in individuals sensitised by disease and specifically sensitised to the drug to be tested.

To those who feel that in their experiments with the homœopathic law of drug action they wish to deal with definitely material quantities, speaking from a molecular standpoint, we would recommend their using preparations of the 6x or 7x type. Once convinced of the homœopathic action, then they can venture into a realm of experiment with potencies belonging to what has already been termed the high potency range. In this latter range it must be made clear that, in the 20c and other greater "attenuations," there is no suggestion that there are any of the original atomic or molecular constituents in the final product. In these higher potencies we are dealing with a physical property the actual nature of which is at present unknown, but which is being steadily investigated by modern research methods.

The evidence is beginning to suggest that we are dealing with a form of radiation. This paper however does not deal with the high potency problem, but is intended to emphasise that adequately informed experiment may be carried out with substances still definitely of the molecular order to obtain the clinical evidence required for demonstration of the principle of homœopathic action.

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APPENDIX A I

Preparation of drugs referred to in the text was carried out by Nelson & Co., London, under supervision of D. W. Everett, M.P.S., and on detailed instruction from W. E. Boyd, M.D.

Aurum Metallicum. All apparatus was sterilised for three hours at 200° C. The vials were of Jena glass. One part of pure gold leaf was triturated with nine parts of lactose in a sterile mortar to which a drachm of absolute alcohol was added to bind the leaf. The first trituration was carried out for four hours. One part of this triturated material was then triturated with nine parts lactose for two hours, after which the process was repeated, until six triturations had been completed. This last trituration was then dissolved in 20 per cent. alcohol in water. Both the alcohol and water were double distilled. This solution provided an apparently clear tincture entitled 7x.

The control was produced in exactly the same way, the lactose alone being used, but six triturations were carried out, taking exactly the same time, the 7x tincture control being produced in the same way.

The 7x in 87 per cent. alcohol referred to was incorporated for experimental purposes, the lactose not dissolving. This experiment reveals that the lower alcohol dilution was necessary, at least for the purpose of these physical tests.

APPENDIX A II

Lycopodium. The first solution was produced by using one part by weight of lycopodium powder to five parts by weight of absolute alcohol prepared by eight days simple maceration. From this mother tincture the 1x, 2x, and 3x were made in double re-distilled absolute alcohol. The alcohol was re-distilled through a Jena glass condenser and the control was of the same alcohol. Jena glass vials were used, and sterilisation was carried out as described previously.

Radium Bromide. One milligram of pure radium bromide (re-crystallised) in a sealed tube was broken under re-distilled sterile water to which was added sufficient absolute alcohol to give 1 milligram in 100,000 milligrams by weight of diluent. This gave a dilution equivalent to 5x. The relatively large quantity of diluent was used in view of the preparation being required to be as free from experimental error as possible. The 6x, 7x, etc., were produced in the usual way, cleaned sterile Jena vials being used throughout, each potency being made in a separate vial.

Arsenicum Album. The potencies of arsenicum album were made from a preparation of arsenic alb. (AS_2O_3), forty years old, and nearest to the arsenic of the type used by Hahnemann. The initial solution was made by dissolving 0·2 grain in 110 minims of 20 per cent. alcohol in double distilled water. All apparatus was baked at 180° C. for seventeen hours. The distillation flask and inner

condenser were of hard glass, the receiver being of Jena glass. Jena glass vials were used throughout, all carefully sterilised. The control was of the same 20 per cent. alcohol, and was previously shown to be arsenic free.

APPENDIX A III

Cinchona Bark (*China*) *and Nux Vomica.* The initial strength used was 1x instead of the mother tincture. This enabled a more perfect extraction to be made, as a larger volume of alcohol could then be used. For cinchona 17 grains of clean powdered bark were used, while for nux vomica 17 grains of the powdered seeds were used in the first place. Maceration in 18 drachms of 87 per cent. alcohol was carried out for five days, and thereafter the tincture thus obtained was used for making the potencies with 87 per cent. alcohol. The alcohol used was specially prepared by British drug houses for spectroscopic work, so that no question of contamination should arise. The filtration was carried out through Watman 44 filter paper. All vials, etc., were sterilised as described previously.

APPENDIX B I

Report on an investigation of *Homœopathic preparations* of *Aurum Metallicum*, on behalf of Dr. W. E. Boyd, 17 Sandyford Place, Glasgow C.3.

Laboratory Nos. 9480, 9481, 9482, 9513, 9514.

The preparations included :—

Aurum Metallicum 1x trituration.

„ „ 6x „

„ „ 7x tincture in 20 per cent. alcohol.

„ „ 7x tincture in 87 per cent. alcohol. In this case practically the whole of the 6x trituration from which it was prepared remained as an insoluble suspension, the majority of the space being occupied by a clear alcoholic solution.

Each of these preparations was received from Messrs. A. Nelson & Co. Ltd., of 73 Duke Street, London, W.1.

Each sample was to be examined spectroscopically for gold, and some of the samples were to be examined for colloidal gold in accordance with a paper entitled " Some of the Physical and Chemical Properties of Colloids," by myself, published in the *British Homœopathic Journal* of November, 1919.

The spectroscopic test for gold was carried out on the ash from the trituration or tincture, as the case might be, using a large quartz spectrograph exploring both the visible and the ultra-violet regions of the spectrum. The experiment was conducted by the arc method of spectrum analysis, the small portion of ash being mounted on spectroscopically standardised copper electrodes.

Gold was found abundantly in the 1x, and it was in good evidence in the case of the 6x trituration, in the 7x tincture in 20 per cent. alcohol and in the 7x tincture made with 87 per cent. alcohol (the sample in this case consisting of the liquid and solid portions mixed).

The original negatives (cut down to lantern slides) accompany this report. The lines significant of gold are marked, but their intensities must not be regarded as indicative of the quantity of gold present in the preparation. The manner of conducting the test was that considered best for getting the strongest evidence of the presence of gold where it was known to exist in only minute proportion.

The colloidal properties of these preparations have been studied by means of an immersion paraboloid dark ground condenser fitted in an efficient microscope, where by using a one-twelfth inch oil immersion objective and a pointolite illuminant, the display of colloidal particles wherever present is quite brilliant.

It must be realised that ultra-microscopy depends upon the reflection of intense light by the particles, and that all colloidal particles of whatever nature are capable of producing the phenomenon. It is, therefore, largely a matter of judgment whether a given particle is due to gold or to some other substance or to dirt. In the present instance, there is little doubt regarding the observations made, inasmuch as the gold particles produced merely by trituration may be expected to be large and to reflect light more easily than the smaller particles of dust occurring commonly in the sugar of milk. The

observations must, therefore, be regarded to some extent as tentative. All one can do to press the matter further would be to make two or three entirely independent triturations of the gold and contrast these with sugar of milk without the gold which had been triturated similarly.

However, I have no doubt that the following observations now made are quite satisfactory.

1. With a little of the 1x trituration in a droplet of water, the display was abundant, the particles being larger than those seen in the following observations.

2. The 7x tincture, 20 per cent. alcohol, gave a good display. This was done three times under various conditions with the same results.

3. The 7x " tincture," 87 per cent. alcohol :

(*a*) The clear liquid only showed no Brownian movement ;

(*b*) The mixture of lactose and tincture also showed no movement.

4. The 6x trituration could, of course, by itself show no Brownian movement. It had to be mixed with a liquid :

(*a*) With ten parts of water it showed Brownian movement ;

(*b*) With 20 per cent. alcohol it showed Brownian movement ;

(*c*) With strong alcohol and poured off there was no display whatever.

These observations prompted the examination of the suspension in the 7x tincture, 87 per cent. alcohol, after pouring off the alcohol and dissolving

in water. The solution showed a good display of colloidal gold.

In reviewing the foregoing results, I form the opinion that in the trituration the gold has been reduced to a very fine state of division, and that quite probably the particles of gold are ground into the surfaces of the particles of lactose, by which they are held more or less imprisoned and are thus unable to float away in the strong alcohol, in which the lactose is insoluble, in sufficient quantity to make their presence evident under the microscope.

On the other hand, when the lactose is dissolved, the particles of gold are free to distribute themselves in the liquid and to exhibit their characteristic movement.

By way of control simple sugar of milk was examined, and while it exhibited numerous colloidal particles, none of them showed the large bright flashes characteristic of certain particles seen in the solutions reported above.

(Signed) S. Judd Lewis.

Note. An additional later report on the ultramicroscopic appearance of similar tinctures, freshly prepared from the trituration compared with a tincture of lactose alone similarly triturated and dissolved, gave the following opinion :—

> "I am of opinion, therefore, that some gold is present in the Aurum Met. trituration in a state of division sufficiently fine to exhibit colloidal properties ; but in order to keep

within the bounds of observation, it is desirable to make the statement guardedly."

APPENDIX B II

Extract from Report of Glasgow City Analyst on Solution of Arsenic submitted

Using the whole of the sample submitted, 5 c.c., we were able to detect the presence of arsenic in the sample labelled 7x. A total quantity of arsenic amounting to something like $\frac{1}{4,000}$ part of a milligram was found, which, corrected for a blank on the reagents used, corresponded with a concentration of 0·06 part per million, which is a fair approximation to the reputed potency.

F. W. Harris, F.I.C.

February 14*th*, 1935.

APPENDIX B III

Reports by S. Judd Lewis, D.Sc.(Tubingen), D.Sc.(London), F.I.C., Ph.C.

LYCOPODIUM

I have analysed spectrographically the mineral constituents in the lycopodium mother tincture, 1x, 2x, 3x, and also in the absolute alcohol wherewith these preparations were made, and the results

are very much as might be anticipated. There is good evidence of calcium, magnesium, sodium and aluminium in the ash from the mother tincture. They appear again in the 1x as they ought to do, much less intense, and in the spectrum negative they are just discernible by us here, although I think it will be scarcely discernible by anyone not practised, in the ash from 2x.

(Signed) S. Judd Lewis.

APPENDIX B IV

Report on the *Absorption Spectra* of *Homœopathic Dilution* of *Certain Tinctures*, on behalf of Dr. W. E. Boyd, Glasgow

Laboratory Nos. 9751, *etc.*

The purpose of the present investigation was to demonstrate that the characteristic composition of a vegetable homœopathic medicine is evident by physical test, over a wide range of potencies prepared in accordance with homœopathic practice.

The experimental procedure was to examine several consecutive potencies by a modern method of absorption spectroscopy, exploring especially the ultra-violet region of the spectrum. This has advantage in that the examination is made without disturbing in any way the composition or physical balance of the preparation. The observations are made on the potency form in which it is administered.

The remedies selected were :—

A. China 1x, 2x, 3x, 4x, 5x, 6x and 7x
B. Nux vomica 1x, 2x, 3x, 4x, 5x

prepared in the ordinary way, except that in order to avoid all possibility of interference by any trace of impurity which may occur in even the best ordinary alcohol, the original tincture and all the dilutions were prepared with alcohol specially purified for spectroscopic research purposes.

The measurements were made by means of a "Judd Lewis" photometer in alignment with a large quartz spectrograph. The procedure was to place in the upper path of the instrument a 10 cm. cell filled with the tincture, and make the light intensity measurements by operating the sector in the lower path. However, a similar cell of the same pure alcohol was placed in the lower path to serve as control, whence it follows that all the effect recorded was due to the drug only. Details are given in "Spectroscopy in Science and Industry" (Blackie), Chapter VIII.

The experimental data are given in the following tables, and graphically displayed in the accompanying curves. All the several curves relative to either remedy are plotted on one chart in order to assist comparison.

It is seen that the absorption is graded with marked regularity, the characteristic feature being repeated in the several dilutions; thus the absorption band at a wavelength of 2,800 in the *China Chart* is obvious in the 4x, 5x and 6x curves,

although it is too feeble to be evident in the 7x. Another band, not so obvious as such, appears as a "step" in the 3x, 4x, 5x, and perhaps also in the 6x, at a wavelength of 3,300.

These bands should appear in highly exaggerated form with the lower dilutions, but it is impracticable to determine them experimentally. The range of experiment is really very limited, viewed scientifically, although as a matter of practice it is very wide.

The *Nux Vomica* curves show less character, but the features, although feebler, may be traced in similar fashion.

The fact that nux gives interesting results only as far as 5x, whereas china responds at 7x is accounted for by the much higher alkaloidal content of the latter, assisted undoubtedly by substantial proportions of tannins and other principles, of which the nux is practically devoid.

The tinctures were prepared by Messrs. Nelson & Co.

(Signed) S. Judd Lewis.

CHINA

Extinction Coefficient.	Wavelength.					
	1x	2x	3x	4x		
0·1	—	6750	—	4260		
0·2	—	6180	—	3925		
0·3	—	5875	4685	3730		
0·4	—	5620	4160	3593		
0·5	6975	5460	3905	3510		
0·6	6725	5370	3700	3405		
0·7	6500	5300	3600	3277		
0·8	6380	5235	3530	3105		
0·9	6300	5180	3490	2994		
1·0	6200	5130	3455	2940		
1·1	6150	5105	3435	2915		
1·2	6100	5080	3405	2892		
1·3	6050	5050	3385	2842	2643	2600
1·4	6010	5030	3365	2800	2745	2552
1·5	5960	5020	3348			2523
1·6	5940	4990	3260			2498
1·7	5890	4980	3200			2484
1·8	5830	4945	3185			2475

CHINA

Extinction Coefficient.	Wavelength.					
	5x			6x		7x
0·04	—			—		3275
0·07	—			—		2890
0·1	3760			4180		2605
0·13	—			3795		2470
0·16	—			3580		2428
0·2	3553			3222		2390
0·23	—			2940		—
0·26	—			2845	2616	—
0·3	3395				2572	—
0·33	3257				—	—
0·36	3114				—	—
0·4	3020				—	—
0·43	2978				—	—
0·46	2937				—	—
0·5	2896				—	—
0·53	2838	2700	2663		—	—
0·56	—		2618		—	—
0·6	—		2585		—	—
0·63	—		2564		—	—
0·66	—		2540		—	—
0·7	—		2517		—	—
0·73	—		2488		—	—
0·8	—		2468		—	—

NUX VOMICA

Extinction Coefficient.	Wavelength.		
	1x	2x	3x
0·1	5950	4035	3890
0·2	5070	3940	3620
0·3	4800	3855	3475
0·4	4680	3790	3340
0·5	4590	3730	3235
0·6	4520	3705	3125
0·7	4450	3685	2975
0·8	4330	3665	2843
0·9	4235	3650	2740
1·0	4180	3640	2695
1·1	4115	3620	2660
1·2	4060	3615	2630
1·3	4020	3605	2595
1·4	3995	3595	2550
1·5	3970	3580	2505
1·6	3955	3575	2450
1·7	3920	3565	2420
1·8	3910	3555	—

NUX VOMICA

Extinction Coefficient.	Wavelength.	
	4x	5x
·04	3355	2585
·07	3105	2410
·1	2960	—
·13	2860	—
·16	2713	—
·2	2628	—
·23	2563	—
·26	2440	—
·3	2393	—
·33	2353	—

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